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CDISC Compliant Implementation of iRECIST and LYRIC for Immunomodulatory Therapy Trials

Kuldeep Sen, Sumida Urval, Yang Wang, Seattle Genetics, Inc.

ABSTRACT

The current RECIST and LUGANO criteria are designed for traditional chemotherapeutic regimens in solid tumor and lymphoma trials respectively. For chemoimmunotherapeutic trials however, immunotherapeutic regimens may cause tumor flares during the treatment and these tumor flares can be associated with clinical and imaging findings suggestive of progressive disease (PD). Without a more flexible interpretation, it is possible that some patients can be prematurely removed from a potentially benefiting treatment, thus leading to underestimation of the magnitude of the clinical benefit of the testing agent. Therefore, for trials involving immunotherapies, iRECIST and LYRIC guidelines were introduced in solid tumor and lymphoma trials respectively.

This paper focuses on the implementation of additional response categories introduced by these guidelines, namely “Unconfirmed PD (iUPD)” and “Confirmed PD (iCPD)” by iRECIST, and “Indeterminate Response (IR)” by LYRIC. This paper will demonstrate how iUPD, iCPD and IR data are collected on CRF, how they are mapped into SDTM and ADaM, and how they are reported. Challenges and solutions from the implementation perspective will be discussed, with emphasis on CDISC compliance and effective reporting.

INTRODUCTION

The RECIST 1.1 criteria provide a standardized and quantifiable set of rules to evaluate tumor response based on changes in the size of target lesions, non-target lesions, and the appearance of new lesions post baseline. With RECIST 1.1, any appearance of unequivocal new lesions or the growth of baseline tumors (>= 20% and absolute increase by 5mm) is associated with disease progression. However, with immunotherapeutic regimens, an unusual pattern of tumor flares called ‘pseudoprogression’ is sometimes observed. This refers to a scenario where an apparent growth of a tumor can take place before a late but meaningful response occurs. To account for these late but meaningful responses after pseudoprogression, iRECIST guidelines were proposed by the RECIST working group in 2017. iRECIST is, in fact, a modified version of RECIST 1.1 for immunotherapy regimens. All responses defined using iRECIST guidelines are designated with a prefix ‘i’ which is indicative of ‘immune based’ therapies.

The Lugano classification is currently the most-used system in lymphoma trials, consisting of complete/partial response (CR/PR), stable disease (SD), and progressive disease (PD). The introduction of immunotherapy-based treatment regimen results in patients displaying clinical improvement with worsening imaging findings such as lesion enlargement or new lesion appearance. Such findings that are suggestive of PD, without clinical deterioration, may represent pseudoprogression. The Lymphoma Response to Immunomodulatory Therapy Criteria (LYRIC) was introduced as an adaptation of the Lugano classification to address such settings.

In this paper we will provide a description of the iRECIST modification to the RECIST 1.1 criteria and the LYRIC modification to the Lugano classification. We will also demonstrate the CRF annotations for SDTM mapping of iRECIST and Lugano-specific CRF pages along with implications for certain ADaM data sets.

RECIST AND IRECIST RESPONSE ASSESSMENT CRITERIA

In RECIST 1.1 we have five response categories: Complete Response (CR), Partial Response (PR), Stable Disease (SD), Progressive Disease (PD), and Not Evaluable (NE). iRECIST requires additional follow-up imaging (4-8 weeks) for the confirmation of an assessment of progressive disease and have additional response categories.

As shown in the first example of a hypothetical scenario in Table 1, the subject will discontinue the treatment at Time Point 2 with the overall assessment of PD per RECIST 1.1. Since iRECIST requires the confirmation of the PD through follow-up imaging, the first PD per RECIST 1.1 in Time Point 2 will be

assigned as ‘Unconfirmed PD’ (iUPD) in iRECIST. A subsequent assessment is required to confirm iUPD, which if confirmed will be termed ‘Confirmed PD’ (iCPD) per iRECIST as shown in the second example in Table 1. The third example demonstrates a case of pseudoprogression in which the iUPD at Time Point 2 was not confirmed and the subject achieved Complete Response at Time Point 5.

	Response Criteria	Time Point 1	Time Point 2	Time Point 3	Time Point 4	Time Point 5
Example 1	**RECIST 1.1**	PR	PD			
Example 2	**iRECIST**	iPR	iUPD	iCPD		
Example 3	**iRECIST**	iPR	iUPD	iSD	iPR	iCR

Table 1: RECIST vs iRECIST responses at different time points

iRECIST response assessments have prefix ‘i’ and the categories are: Complete Response (iCR), Partial Response (iPR), Stable Disease (iSD), Progressive Disease, Unconfirmed (iUPD), Progressive Disease, Confirmed (iCPD) and Not Evaluable (NE).

Some key points to note about iRECIST are:

- iRECIST is NOT yet a validated set of response criteria and should be used for exploratory analysis only.
- Additional information about New Lesions is required in iRECIST. New Lesions in iRECIST are measured as New Target Lesions sum of measurements (iSOM) or as New Non-Target Lesions’ status. The measurement of the new lesions in iRECIST follows RECIST 1.1 principles.
- iRECIST is different from RECIST 1.1 only after the first progression is observed. The first PD per RECIST 1.1 is “unconfirmed” for iRECIST and termed as ‘iUPD.’ The occurrence of iUPD must be confirmed in the next scan between 4-8 weeks.
- If iUPD is confirmed in the subsequent assessment, then it becomes a ‘confirmed’ PD termed ‘iCPD’ in iRECIST with the date of progression being the date of iUPD that was initially observed.
- If iUPD is not confirmed in the subsequent assessment, i.e. if it is followed by an iSD, iPR, or iCR, then the bar is reset for iUPD. In other words, the original iUPD will be ignored and it must occur again and confirmed at the subsequent assessment to be assigned as iCPD.
- There are generally two ways an iUPD can be confirmed:
  a. The New Target/Non-Target Lesions from the last assessment that contributed to the determination of iUPD grow to meet PD criteria per RECIST 1.1
  b. A new PD per RECIST 1.1, distinct to the iUPD from the last assessment, is observed.

CRF DESIGN/DATA COLLECTION AND SDTM ANNOTATION

Data collection and CRF design for Target and Non-Target lesions for RECIST 1.1 and iRECIST are identical and are not demonstrated here. The main difference is how the new lesion information is collected. With RECIST 1.1, appearance of a new ‘unequivocal’ lesion is enough for the determination of PD and the protocol may choose not to collect additional information of new lesions. However, with iRECIST, more information is needed about this new lesion, which themselves can be added to the collection of target and non-target lesions being followed throughout later visits. As shown in Figure 1 below, the type of new lesion – Target/Non-Target – and their measurements are collected and mapped to SDTM.TR and SDTM.TU. It is important to note that these new Target/Non-Target lesions are independent of the baseline Target/Non-Target lesions identified in the TU domain.

TU=Tumor Identification **TR=Tumor Results**

Imaging (iRECIST) – New Lesions

		TUGRPID = NEW	TRGRPID = NEW
Lesion ID	TUSPID TRSPID		TULNKID/TRLNKID = "T" || Lesion ID
Tumor Site	TULOC		
Site Description	SITDSC in SUPPTU		
Unequivocal?		[1] Yes [0] No	TRORRES when TRTEST = Tumor State
Visit			
Not Assessed by CT scan	TRSTAT		☐[1]
Exam Type			TUMETHOD TRMETHOD
Type of lesion	TUORRES when TUTEST = Tumor Identification		**Pulldown:** [1] New Lesion Target (NL-T) [2] New Lesion Non-Target (NL-NT)
If new lesion target, longest diameter of non-nodal lesion (mm)			TRORRES when TRTEST = Longest Diameter
If new lesion target, short axis of nodal lesion (mm)			TRORRES when TRTEST = Short Axis
For subsequent visits only: If new lesion non-target, provide lesion status			**Pulldown:** [1] Present [2] Absent [3] Unequivocal Progression TRORRES when TRTEST = Tumor State of New Non-Target

Figure 1: SDTM Annotation of New Lesion Page for iRECIST

Specific to iRECIST is the collection of the sum of diameters (measurements) of New Target Lesions (iSOM) that are collected in a separate CRF page as show in Figure 2 below.

TR=Tumor Results

Imaging (iRECIST) – i-Sum of Measurements: New Lesions

#	Visit	iSOM of New Target Lesions for this visit (mm) TRORRES/TRORRESU when TRTEST=Sum of Diameter	Not Applicable [NOT SUBMITTED]
1			

Figure 2: SDTM Annotation of sum of diameter for new target lesion page for iRECIST

The response assessments for RECIST 1.1 and iRECIST are collected on the same page and mapped as shown in Figure 3 below.

Investigator assessment of **OVERALL RESPONSE per RECIST** at this time point *RSCAT=RECIST 1.1* *RSEVAL=INVESTIGATOR*	**Pulldown:** [1] Complete Response [2] Partial Response [3] Stable Disease [4] Progressive Disease [95] Not Evaluable [96] Not Applicable *RSORRES when RSTEST = Overall Response*
Investigator assessment of **OVERALL RESPONSE per iRECIST** at this time point *RSCAT = iRECIST* *RSEVAL=INVESTIGATOR*	**Pulldown:** [1] Complete Response (iCR) [2] Partial Response (iPR) [3] Stable Disease (iSD) [4] Progressive Disease, unconfirmed (iUPD) [5] Progressive Disease, confirmed (iCPD) [95] Not Evaluable *RSORRES when RSTEST = Overall Response*
If Unconfirmed Progressive Disease (iUPD), is patient considered clinically stable to continue treatment?	**Pulldown:** [1] Yes [0] No [96] Not Applicable *IUPDCSCT in SUPPRS*

Figure 3: CRF Annotations of RECIST and iRECIST Responses

Since confirmation of progressive disease is the key facet of iRECIST, they are collected in a separate CRF page and annotated as shown in Figure 4 below.

RS=Disease Response

Confirmation of Progressive Disease

Complete the assessment within the protocol-specified window after each Unconfirmed Progressive Disease (iUPD)

#	Visit of iUPD Response	Was this iUPD confirmed? *RSORRES when RSTEST = Confirmation of iUPD*	If No, please specify reason iUPD not confirmed *NCIUPD in SUPPRS*	If Other, please specify *NCIUPDSP in SUPPRS*
1				

Figure 4: Annotation of the CRF Page Used for Confirmation of PD

SDTM implementation of iRECIST data is more challenging compared to RECIST 1.1 simply because they collect more data and utilize additional CRF pages. It is also easy to confuse New Target/Non-Target lesions with Baseline Target/Non-Target lesions because they can use the same TRTEST/TRTESTCD as shown in Table 2. In this case, TRGRPID plays a key role in distinguishing between them. In addition, since confirmation of PD is collected on a separate page and is used to confirm the PD collected on the response assessment page, calculation of the date of PD also requires additional programming steps.

TRGRPID	TRTEST	TRTESTCD
NEW	Longest Diameter	LDIAM
NEW	Short Axis	SAXIS
NEW	Sum of Diameters	SUMDIAM
NEW	Tumor State	TUMSTATE
NEW	Tumor State of New Non-Target	TSTNWNT
NON-TARGET	Tumor State	TUMSTATE
TARGET	Longest Diameter	LDIAM
TARGET	Short Axis	SAXIS
TARGET	Sum of Diameters	SUMDIAM
TARGET	Tumor State	TUMSTATE

Table 2: SDTM TR Test and Test Codes for New vs. Baseline Lesions

In the ADaM implementation of response data in ADRS, PARCATy is used to categorized RECIST 1.1 and iRECIST. One important thing to note is that a PARAMCD cannot be associated with multiple PARCATy. In order to maintain such a many-to-one relationship between PARAM and PARCATy, we used the prefix 'i' to create unique PARAMCDs for iRECIST and RECIST 1.1 in ADRS as shown in Table 3. Assigning the same PARAMCD value to both RECIST 1.1 and iRECIST will not be compliant to ADaM guidelines.

subjid	parcat1	paramcd	param	avisit	avalc
1-01	RECIST 1.1	OVRSP	Overall Response - RECIST 1.1	Cycle 1	SD
1-01	RECIST 1.1	OVRSP	Overall Response - RECIST 1.1	Cycle 2	PD
1-01	RECIST 1.1	BOR	Best Overall Response - RECIST 1.1		SD
1-01	iRECIST	IOVRSP	Overall Response - iRECIST	Cycle 1	SD
1-01	iRECIST	IOVRSP	Overall Response - iRECIST	Cycle 2	iUPD
1-01	iRECIST	CONFIUPD	Confirmation of iUPD	Cycle 2	No
1-01	iRECIST	IOVRSP	Overall Response - iRECIST	Cycle 3	iPR
1-01	iRECIST	IOVRSP	Overall Response - iRECIST	Cycle 4	iUPD
1-01	iRECIST	CONFIUPD	Confirmation of iUPD	Cycle 4	Yes
1-01	iRECIST	IOVRSP	Overall Response - iRECIST	Cycle 5	iCPD
1-01	iRECIST	IBOR	Best Overall Response - iRECIST		iPR

Table 3: Hypothetical example of data collected in ADRS

It is also important to note that the Time to Disease Progression (TPD) in iRECIST is calculated differently from RECIST 1.1. Using the same example from Table 3, TPD per RECIST 1.1 is calculated as time to the first occurrence of PD which is the assessment at Cycle 2. However, in iRECIST, TPD is calculated as time to the iUPD assessment that was subsequently confirmed by iCPD; in Table 3, TPD will thus be based on the assessment date at Cycle 4.

While the design of tables and figures summarizing efficacy is project- and study-specific, at the time of this writing, RECIST 1.1 should still be used in primary and secondary endpoint analyses and iRECIST should only be used for exploratory analyses. A typical Best Overall Response table shell for iRECIST may look like Table 4.

Table 14.2.1.3 Summary of Best Overall Response by Investigator per iRECIST
Full Analysis Set

	Total
Best Overall Response[a], n (%)	
Confirmed Complete Response (iCR)	x (xx)
Confirmed Partial Response (iPR)	x (xx)
Stable Disease (iSD)	x (xx)
Confirmed Progressive Disease (iCPD)	x (xx)
Unconfirmed Progressive Disease (iUPD)	x (xx)
Not Evaluable (NE)[c]	x (xx)
# of Patients with Confirmed Objective Response (iCR or iPR), n (%)	*x (xx)*
95% CI[d] for iORR	(xx.x, xx.x)

a. Best overall response according to iRECIST guidelines (Seymour 2017);

Table 4: Example of a Best Overall Response Table Shell

LUGANO AND LYRIC ASSESSMENT CRITERIA

The Lugano system assigns response based on the modified Deauville five-point scale. (PET-CT is recommended to be used for response assessments in FDG-avid histologies, and CT for low or variable FDG avidity.) The SUV_{max} of the most metabolically active lesion is determined and based on where that value falls in the Lugano 5PS, the response is assigned as Complete (Metabolic) Response, Partial (Metabolic) Response, Stable Disease or No Metabolic Response, and Progressive (Metabolic) Disease.

The LYRIC modification adds the term 'indeterminate response' to the Lugano criteria to address any pseudoprogression, until the lesions are confirmed as being true progression. There are 3 types of indeterminate response (IR).

1. IR1 - increase in overall tumor burden (sum of the product of the diameters [SPD]) of ≥ 50% of up to 6 measurable lesions in the first 12 weeks of therapy, without clinical deterioration.
2. IR2 - appearance of new lesions or an increase of ≥ 50% in existing lesion(s) at any time during treatment while there is a lack of overall progression (<50% increase) in overall tumor burden, as measured by SPD of up to 6 lesions at any time during the treatment.
3. IR3 - increase in FDG uptake of 1 or more lesion(s) without an increase in lesion size or number.

With any of these three IRs, a repeat imaging is done after 12 weeks (or earlier) to re-evaluate response and to check for true progression vs pseudoprogression. The response is re-evaluated as per the following considerations.

1. IR1 - the comparison should be between IR1 and the current SPD, with an increase of ≥ 10% constituting PD. An increase of ≥ 5 mm in at least one lesion for lesions ≤ 2 cm and 10 mm for lesions > 2 cm should also be considered.
2. IR2 - the new or growing lesion(s) should be added to the target lesion(s), up to a total of no more than 6 total lesions. If the SPD of the newly defined set of target lesions has increased by ≥ 50% from their nadir the patient should be considered to have PD.
3. IR3 - because inflammatory responses may result in an increase in the standardized uptake value of a lesion, the patient will not be considered to have PD unless there is evidence of PD by an increase in lesion size or the development of new lesions.

If a patient is assessed as having IR and then "true" PD at a subsequent time point (without an intervening objective response between IR and PD), the IR assessment should subsequently be

corrected to PD for reporting purposes to the date of the prior designation of IR. Even if the lesions may remain stable during the time of observation, the initial designation of IR should be changed to PD.

CRF DESIGN/DATA COLLECTION AND SDTM ANNOTATION

We have introduced a modified Lugano CRF (Figure 5) that contains the LYRIC additions of intermediate responses to be used in our studies. The CRF contains the different Lugano response options followed by a field for intermediate response (Figure 5). For any IR2 responses we have subsequent CRFs that collect more information about the new or growing lesions.

Investigator assessment of **OVERALL RESPONSE per Lugano 2014** at this timepoint **RSORRES when RSTESTCD =OVRLRESP**	**Pulldown:** *If 'CT only…' or 'Clinical only':* [CT-1] Complete Response [CT-2] Partial Response [CT-3] Stable Disease [CT-4] Progressive Disease [CT-5] Not Evaluable *If 'PET or PET/CT…':* [PET-1] Complete Metabolic Response [PET-2] Partial Metabolic Response [PET-3] No Metabolic Response [PET-4] Progressive Metabolic Disease [PET-5] Not Evaluable
Did the patient meet criteria for an indeterminate response (IR) per LYRIC?	**Pulldown:** [1] Yes [0] No [95] Not Evaluable **LYRICIR in SUPPRS**
If ***Yes***, please select the response subcategory:	**Pulldown:** [1] IR1 [2] IR2 [3] IR3 **RSORRES when RSTESTCD = LYRICRSP**

Figure 5: Annotation of Lugano and LYRIC Response Assessments

The baseline response status – based on the set of Target and Non-Target lesions identified at baseline – cannot be changed once identified, except to add additional measurements to baseline Non-Target Lesions. These baseline Non-Target lesions become Target Lesions per IR2 at a subsequent visit. Target and Non-Target Lesions identified at baseline will be assessed for the duration of the response assessments (see Figure 6).

LYRIC IR2 Lesions

TU=Tumor Identification **TR=Tumor Results**

Complete one unique form for every lesion that meets the criteria for an IR2 response

Specify which form the lesion was reported on prior to becoming IR2: NOT SUBMITTED	Pulldown: [1] Imaging (Lugano 2014) – New Lesions [2] Imaging (Lugano 2014) – Non-Target Lesions (Baseline) [3] Imaging (Lugano 2014) – Target Lesions (Baseline)
Specify which log line the IR2 Lesion is reported on, from the form reported above:	NOT SUBMITTED

- For **New Lesions**, report lesion data from all visits prior to the visit where the new lesion was first reported.
- For **Non-Target** lesions (Baseline), report lesion data from Baseline through PD (PD per LYRIC after an IR2) or End of Study, whichever comes first
- For **Target** lesions (Baseline), do not report any data below

VISIT
VISIT
TRTESTCD= TUMSTATE
TRMETHOD
TUMETHOD
TRORRES/ TRORRESU when TRTESTCD =LDIAM
TRSTAT when TRTESTCD =LDIAM, LPERP or TUMSTATE
TRSTAT when TRTESTCD = PETSUV
TRORRES/ TRORESU when TRTESTCD =LPERP
TRORRES when TRTESTCD = PETSUV

#	Visit	Lesion Status by Visit *(Report for New Lesions Only)*	Exam Type *(Report for New Lesions Only)*	Measurement #1	Measurement #2	Not Assessed by CT	SUV_{max} Activity *(Report for New Lesions Only)*	SUV_{max} Activity Not Assessed *(Report for New Lesions Only)*
		[1] Present, not Target or Non-Target [2] Absent	[1] CT [5] PET [6] PET/CT [7] CT Neck [8] CT Chest [9] CT Abdomen [10] CT Pelvis [98] Other [0] None					
1						▫[1]		▫[1]
2						▫[1]		▫[1]

Figure 6: LYRIC IR2 Lesion Measurement Annotation

At each post-baseline visit, the SPD for the set of IR2 Target Lesions must be assessed and recorded. In addition, the nadir for that set of IR2 Target Lesions must also be determined and recorded (Figure 7).

TR=Tumor Results

LYRIC IR2 SPD ASSESSMENT

Specify the visit where this instance of IR2 is reported in the Response Assessment form	

For all visits, calculate the SPD that includes Baseline Target lesions and lesions that later became Target per IR2.

	VISIT	*TRORRES when TRTESTCD=SUMPPD*	*NADIR in SUPPTR*
#	Visit	SPD per LYRIC (cm^2)	Nadir Visit
1			▫[1]
2			▫[1]

Figure 7: Annotation for LYRIC IR2 SPD Measurements of the Lesion

Per the LYRIC criteria, a response of IR2 followed by a subsequent response of PD necessitates the change of the IR2 value to PD. However, if a response of IR2 is followed by a subsequent non-PD response, the IR2 value will remain as is. We used the following method to handle this scenario at the ADaM level. Please note that the date of the original IR2 response stays the same:
An example scenario is presented in this paper. At Cycle 3 the Lugano response was collected as NE. However, there was also an IR response collected as per LYRIC (Figure 5). The Cycle 4 Lugano response was a PD. This means that as per LYRIC, the Cycle 3 LYRIC response will be a PD. To represent this in the ADaM level a new PARAMCD and PARCAT ("OVRSP" and "LYRIC" in Table 5) are created. The PARAMCD "OVRLRSP" contains the Lugano response of "NE" at Cycle 3, and the PARAMCD "OVRSP" contains the LYRIC response of "PD" also at Cycle 3. The new PARAMCD "OVRSP" created will contain the response value of PD (changed from IR2 in Cycle 3 of this example) and based on reporting requirements either the original Lugano NE response or the modified LYRIC PD response can be used. Creation of the new records with a different PARCAT value and PARAMCD value is helpful in following the 'one proc away' principle for LF creation.

Another way of reporting the LYRIC IR response can be done by using flag variables. This will depend on the analysis design outlined in the study SAP and can possibly get too complicated to properly implement the one-proc-away principle.

	PARCAT	PARAMCD	PARAM	AVISIT	AVALC
1	LUGANO	OVRLRSP	Overall Response - Lugano	Cycle 1	PR
2	LUGANO	OVRLRSP	Overall Response - Lugano	Cycle 2	PR
3	LUGANO	OVRLRSP	Overall Response - Lugano	Cycle 3	NE
4	LUGANO	OVRLRSP	Overall Response - Lugano	Cycle 4	PD
5	LYRIC	OVRSP	Overall Response - LYRIC	Cycle 1	PR
6	LYRIC	OVRSP	Overall Response - LYRIC	Cycle 2	PR
7	LYRIC	OVRSP	Overall Response - LYRIC	Cycle 3	PD
8	LYRIC	OVRSP	Overall Response - LYRIC	Cycle 4	PD

Table 5: Creation of a New PARAMCD to Handle LYRIC Response

Two different best response variables can be derived for the Lugano and LYRIC criteria based on reporting requirements. The LYRIC best response will be derived after confirming whether the IR response is PD or not.

CONCLUSION

The CRF and its annotation described in this paper are for illustration purposes only. Your study will have different CRF designs, and the design for ADaMs will also depend on reporting requirements often specified in TLF shells and the SAP. Ideally, TLF creation should be one PROC away from the ADaM data set.

Immunotherapeutics are a major advancement in the treatment of an increasing number of cancer types. The growing number of immunotherapy-based clinical trials will result in an increased use of the iRECIST and LYRIC criteria in analysis and reporting. We hope that the exploration we conducted in this paper will be part of a larger effort that will lead to the standardization of the implementation of these guidelines for compliant and effective analysis and reporting.

REFERENCES

L Seymour. 2017. iRECIST: guidelines for response criteria for use in clinical trials testing immunotherapeutics

J Shostak. 2017. ADaM Grouping: Groups, Categories, and Criteria. Which Way Should I Go?

L Seymour and P Brown-Walker. Conference iRECIST 2018: A Guideline for Data Management and Data Collection for Trials Testing Immunotherapeutics. Available at https://vimeo.com/260117937

BD Cheson et al. 2014. Recommendations for Initial Evaluation, Staging, and Response Assessment of Hodgkin and non-Hodgkin Lymphoma: The Lugano Classification

RL Van Heertum et al. 2014. Lugano 2014 Criteria for Assessing FDG-PET/CT in Lymphoma: An Operational Approach for Clinical Trials

BD Cheson et al. 2016. Refinement of the Lugano Classification Lymphoma Response Criteria in the Era of Immunomodulatory Therapy

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CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the authors at:

Kuldeep Sen
kusen@seagen.com

Sumida Urval
surval@seagen.com

Yang Wang
yawang@seagen.com